The Oosterschelde, a changing ecosystem after the completion of the Deltaworks

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Rijkswaterstaat RIKZ

LACPR Workshop Fieldtrip
July 12th 2006

towards an integrated approach

Protest!

OOSTERSCHELDE OPEN !! DAT NOOIT !!

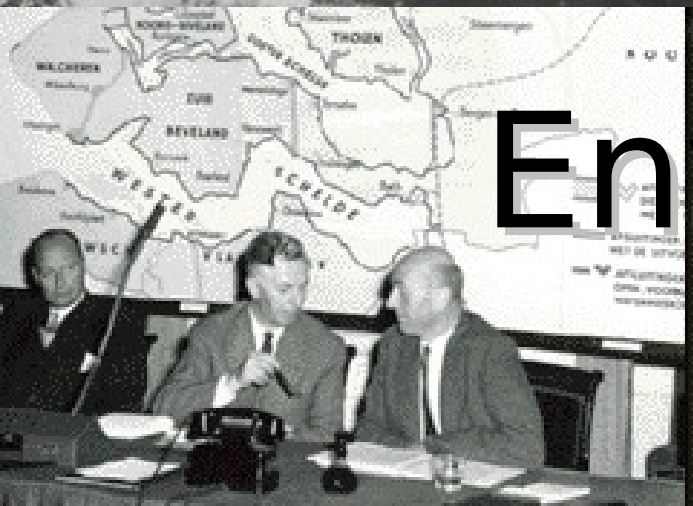
OPEN
WATERSTAAT ERKEN UW FOUT
LAAT DE OOSTERSCHELDE ZOUT

YE 96
LAAT DE OOSTERSCHELDE OPEN!!

Safety

or

and



Environment

Primary effects:

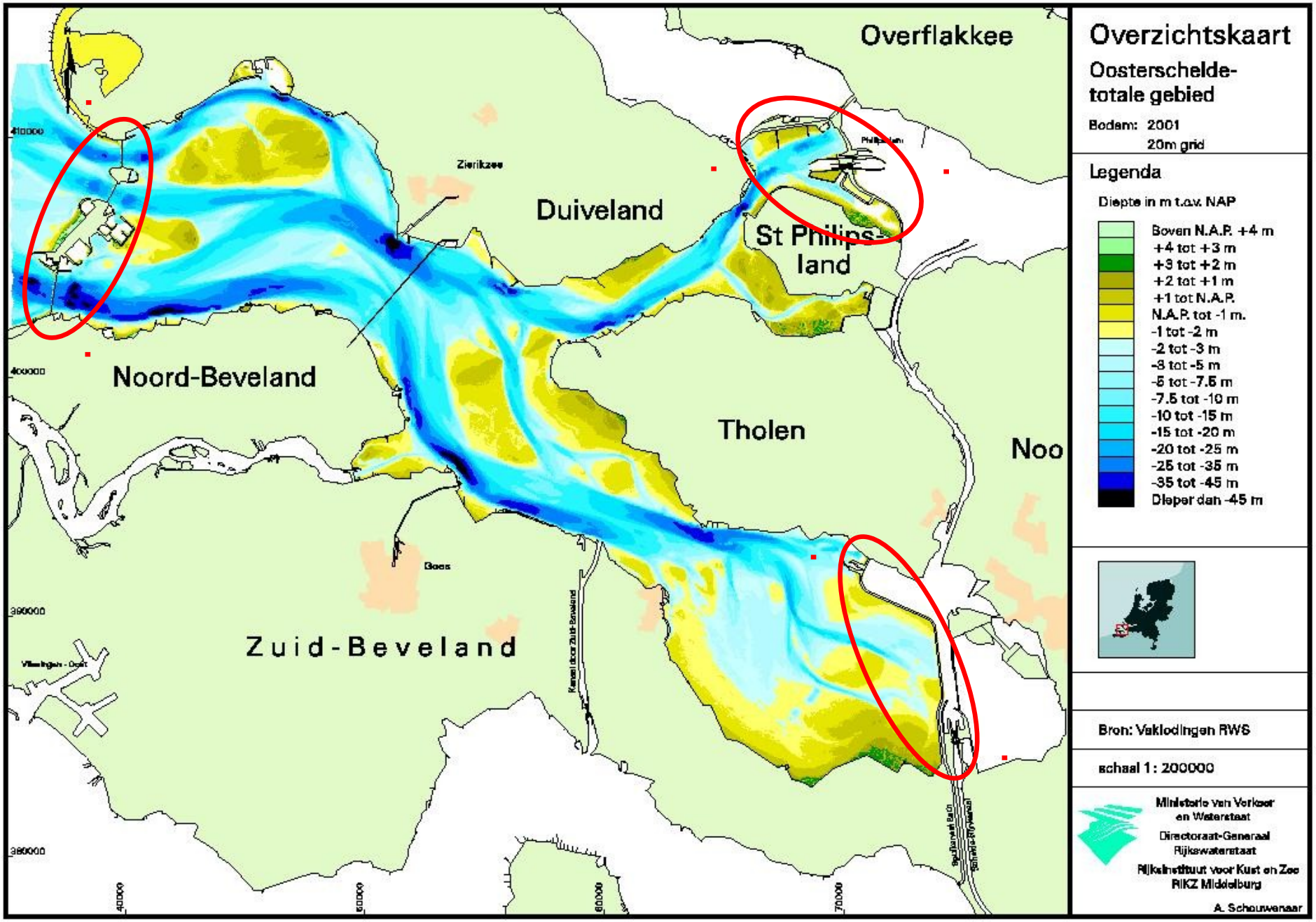
Changes in hydrodynamics & morphology

Secondary effects:

Ecological responses to a changing environment

Tertiary effects:

Reactions of man to a changing ecosystem



Overzichtskaart

Oosterschelde-totale gebied

Bodem: 2001
20m grid

Legenda

Diepte in m t.o.v. NAP

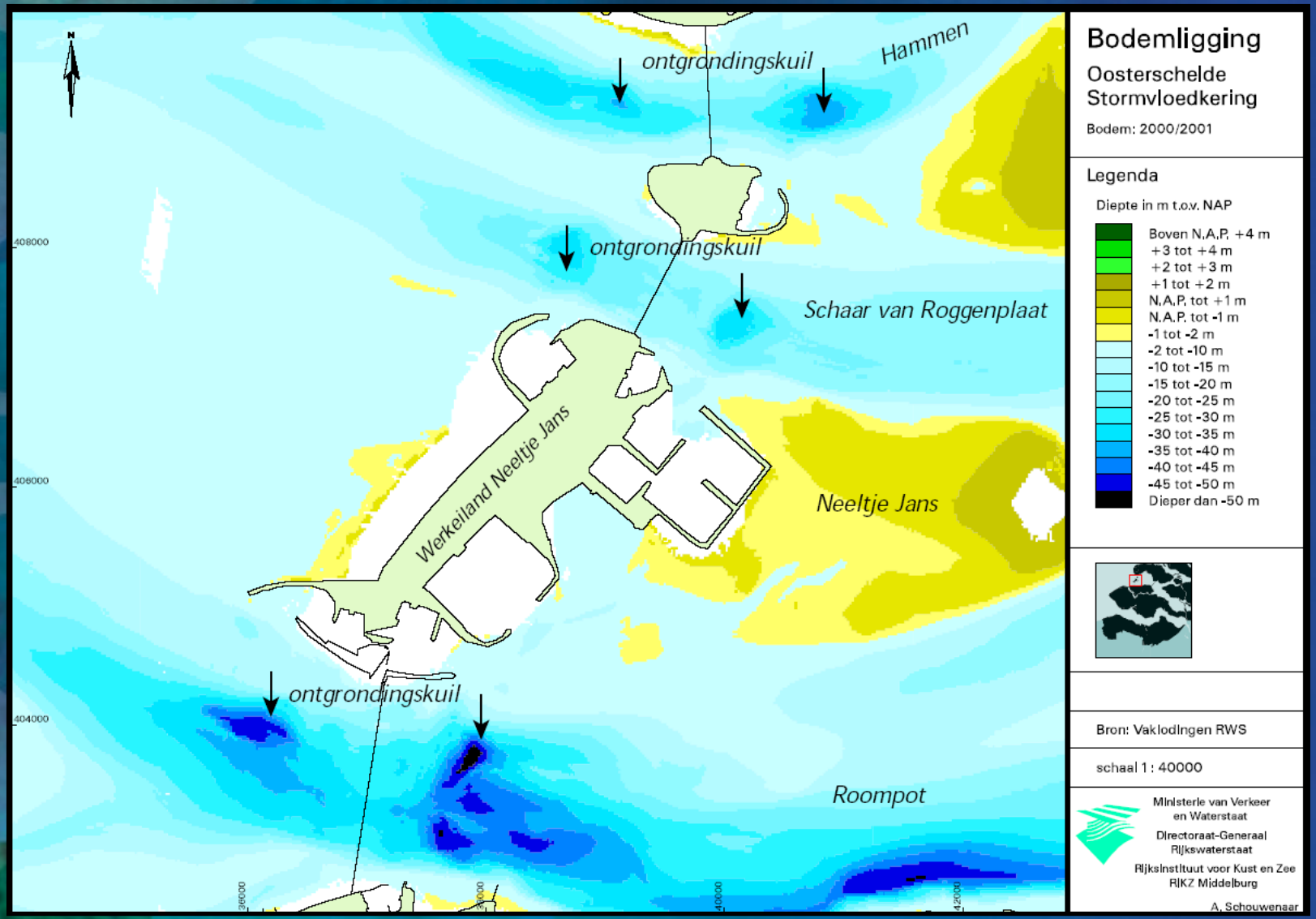
- Boven N.A.P. +4 m
- +4 tot +3 m
- +3 tot +2 m
- +2 tot +1 m
- +1 tot N.A.P.
- N.A.P. tot -1 m.
- -1 tot -2 m
- -2 tot -3 m
- -3 tot -5 m
- -5 tot -7.5 m
- -7.5 tot -10 m
- -10 tot -15 m
- -15 tot -20 m
- -20 tot -25 m
- -25 tot -35 m
- -35 tot -45 m
- Dieper dan -45 m

Bron: Vaklodingen RWS

schaal 1 : 200000

Ministerie van Verkeer en Waterstaat
Directoraat-Generaal Rijkswaterstaat
Rijksinstituut voor Kust en Zee
RIKZ Middelburg

A. Schouwenaar



Bodemligging

Oosterschelde Stormvloedkering

Bodem: 2000/2001

Legenda

Diepte in m t.o.v. NAP

- Boven N.A.P. +4 m
- +3 tot +4 m
- +2 tot +3 m
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- -10 tot -15 m
- -15 tot -20 m
- -20 tot -25 m
- -25 tot -30 m
- -30 tot -35 m
- -35 tot -40 m
- -40 tot -45 m
- -45 tot -50 m
- Dieper dan -50 m

Bron: Vaklodingen RWS

schaal 1 : 40000

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RIKZ Middelburg
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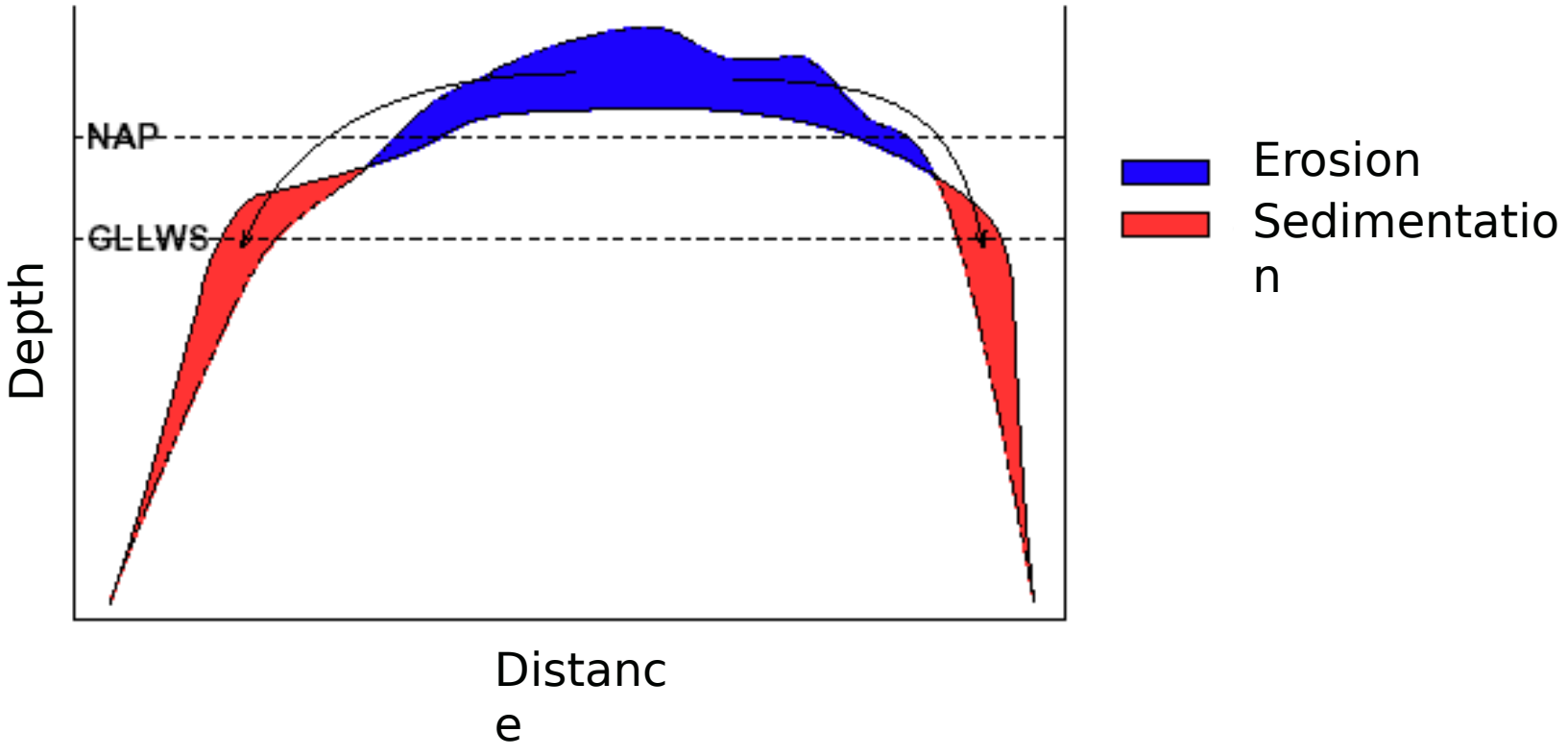
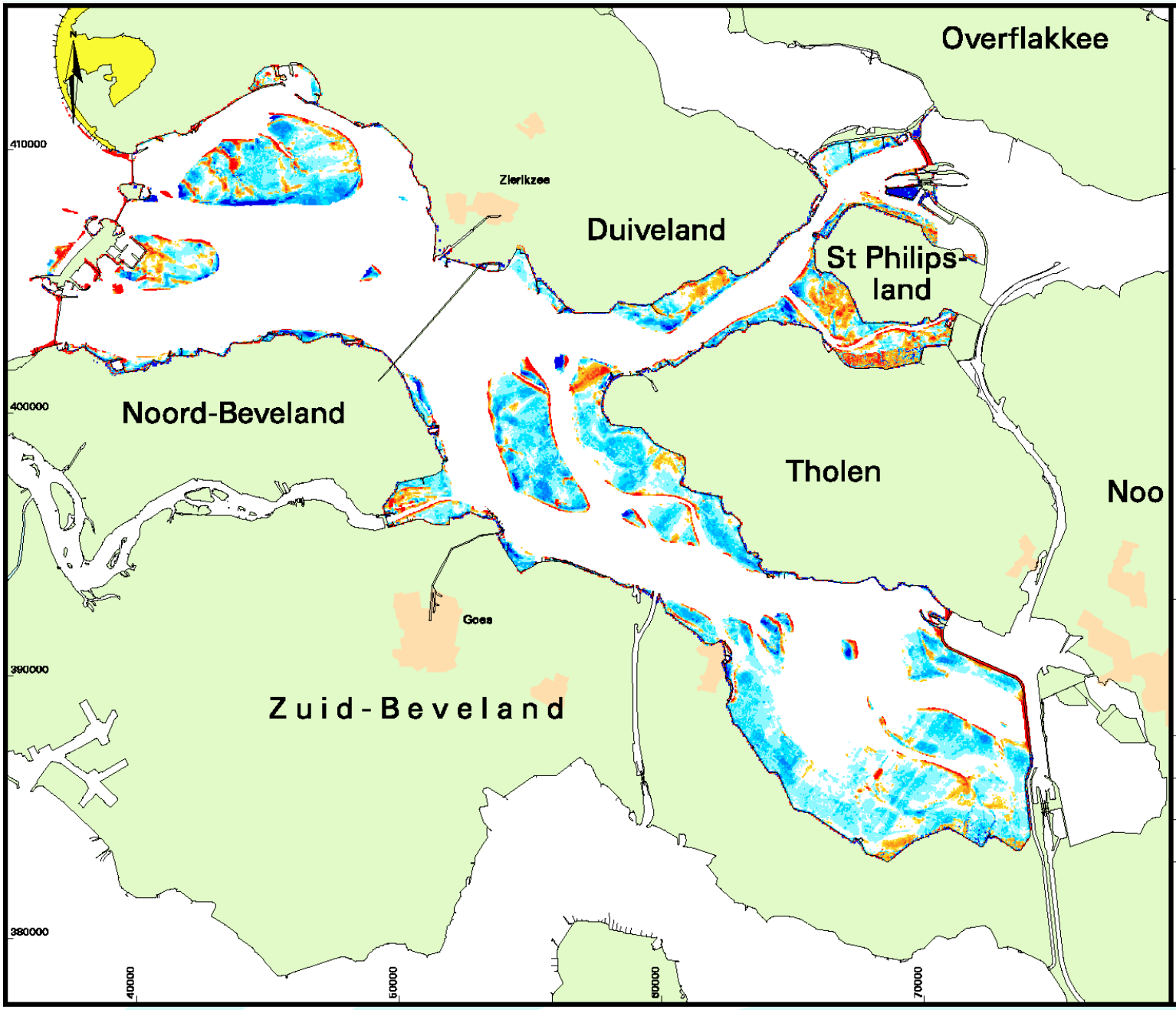
Erosion of Tidal Mudflats



NAP: Dutch Ordinance Level

GLLW: Mean Low Waterlevel at Springtide



Difference map

1983 – 2001

Verschil in m

- Verdieping meer dan 1 m
- -1 tot -0.8 m
- -0.8 tot -0.6 m
- -0.6 tot -0.4 m
- -0.4 tot -0.2 m
- 0.2 tot 0.4 m
- 0.4 tot 0.6 m
- 0.6 tot 0.8 m
- 0.8 tot 1 m
- Verondieping meer dan 1 m

Bron: Vaklodingen RWS

schaal 1 : 200000

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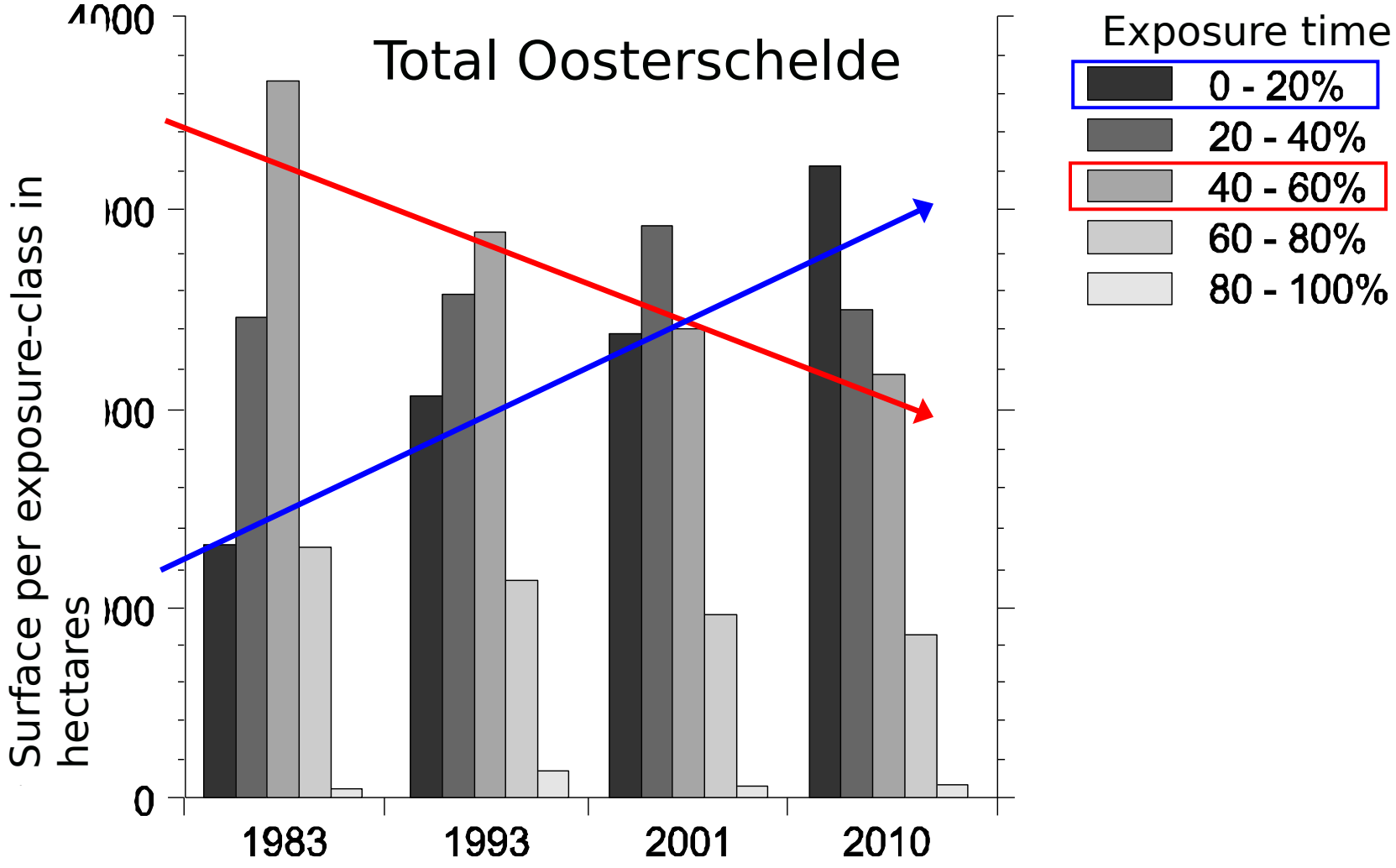
Decreasing exposure time of tidal flats



Primary effects:

Changes in hydrodynamics & morphology

Secondary effects:

Ecological responses to a changing environment

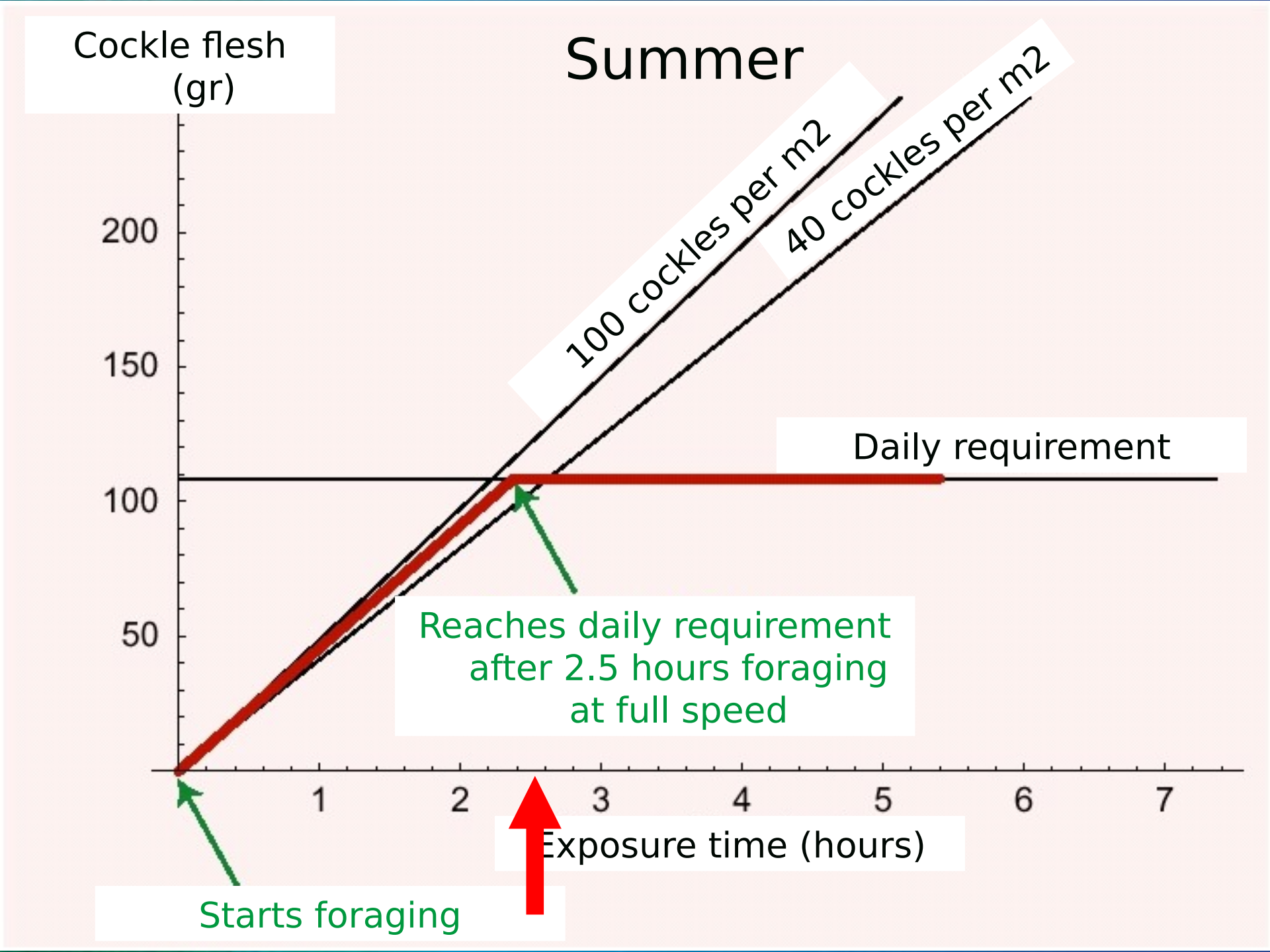
Tertiary effects:

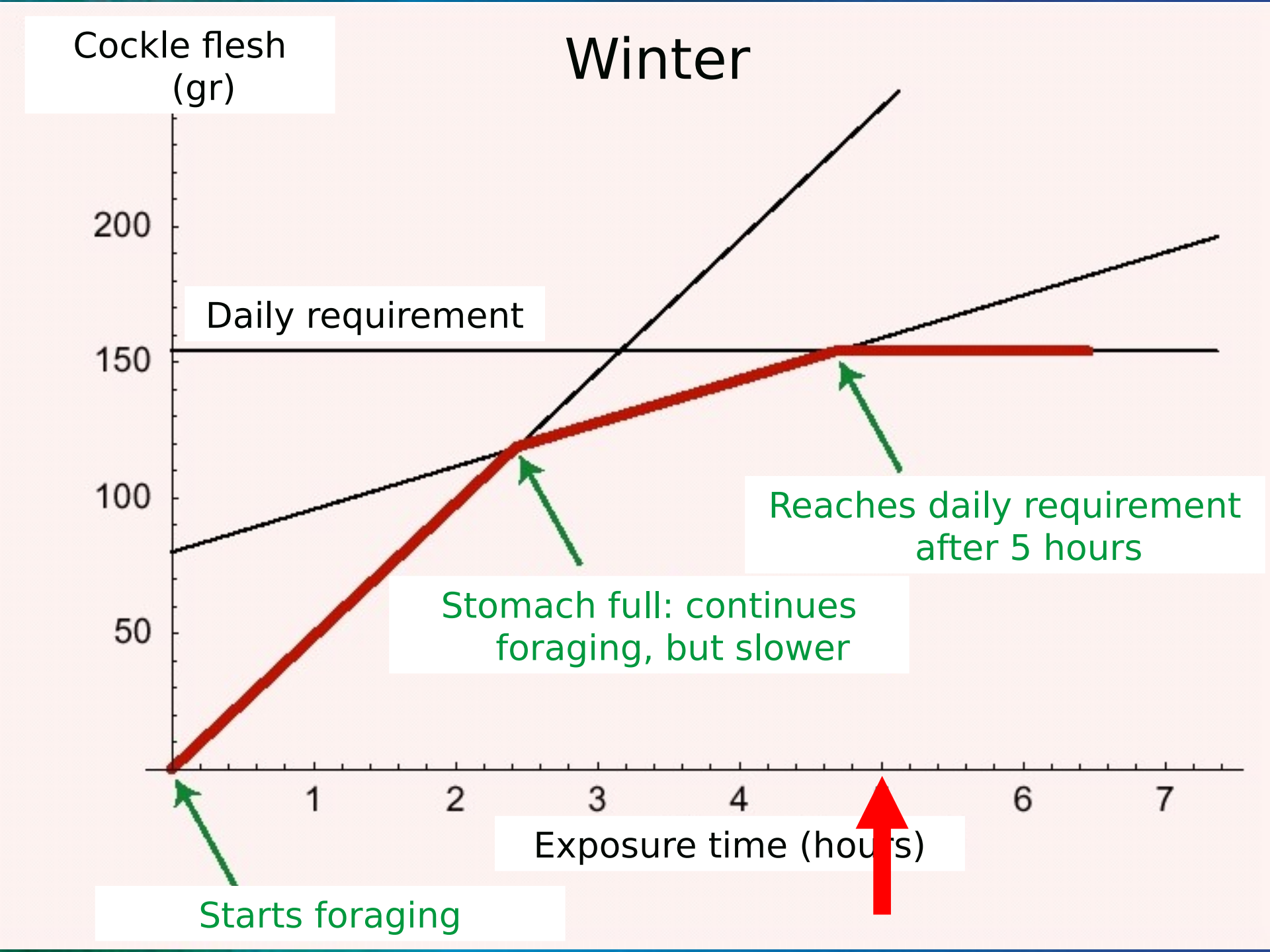
Reactions of man to a changing ecosystem

Well predicted: decline of salt marshes

ecreasing exposure time was predicted.
...but not it’s ecological consequen

Example Oystercatcher


Cockle flesh
(gr)
Summer
100 cockles per m2
40 cockles per m2
Daily requirement
200
150
100
50
Reaches daily requirement
after 2.5 hours foraging
at full speed
1
2
3
4
5
6
7
Exposure time (hours)
Starts foraging

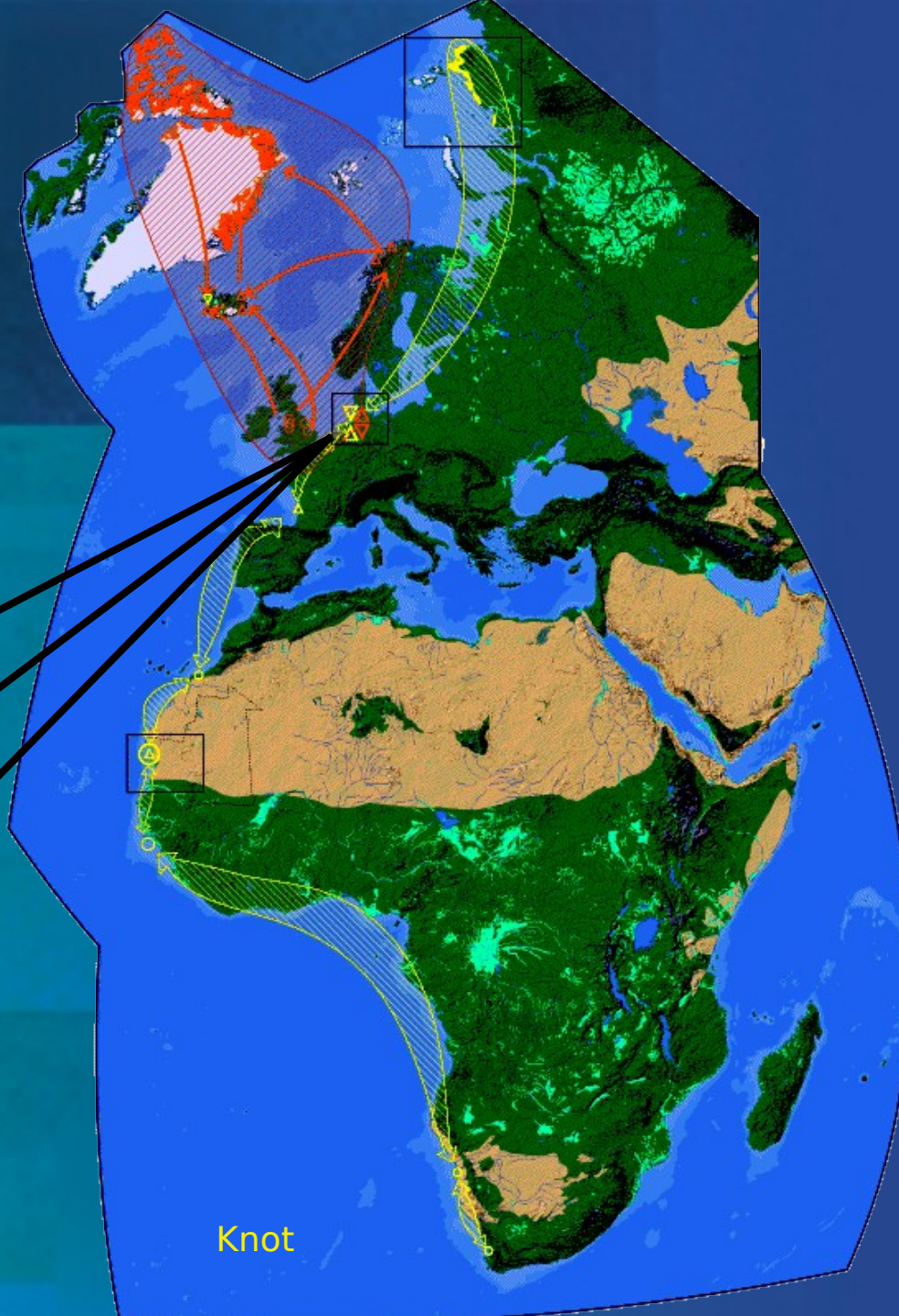

Cockle flesh (gr)
Winter
200
150
100
50
Daily requirement
Reaches daily requirement after 5 hours
Stomach full: continues foraging, but slower
1
2
3
4
6
7
Exposure time (hours)
Starts foraging

Netherlands intertidal areas on crossroad of flyways Arctic <-> Africa

Waddensea
260 000 ha.

Oosterschelde
37 000 ha.

Westerschelde
43 000 ha.



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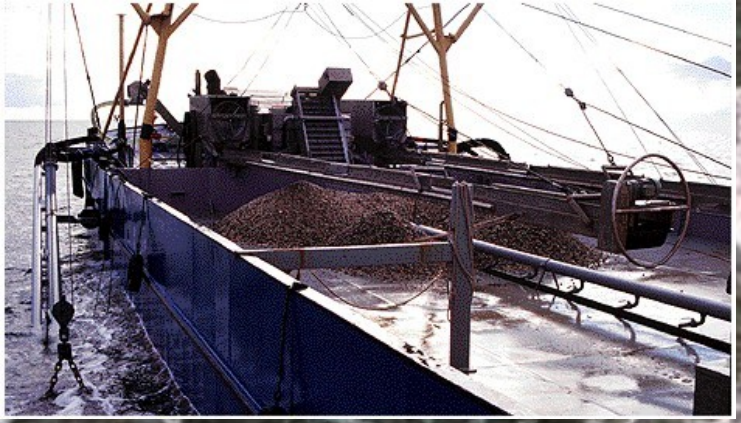
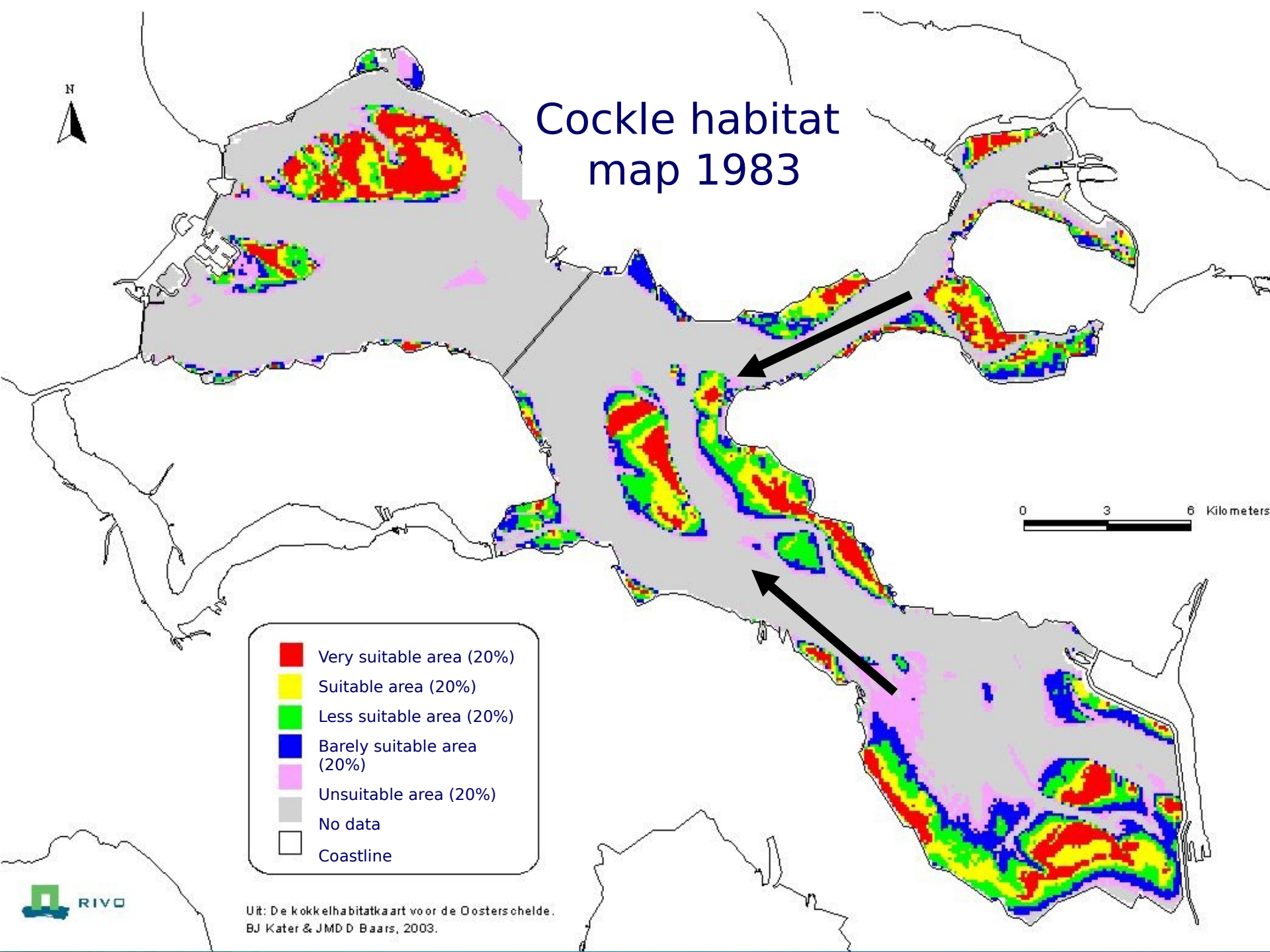
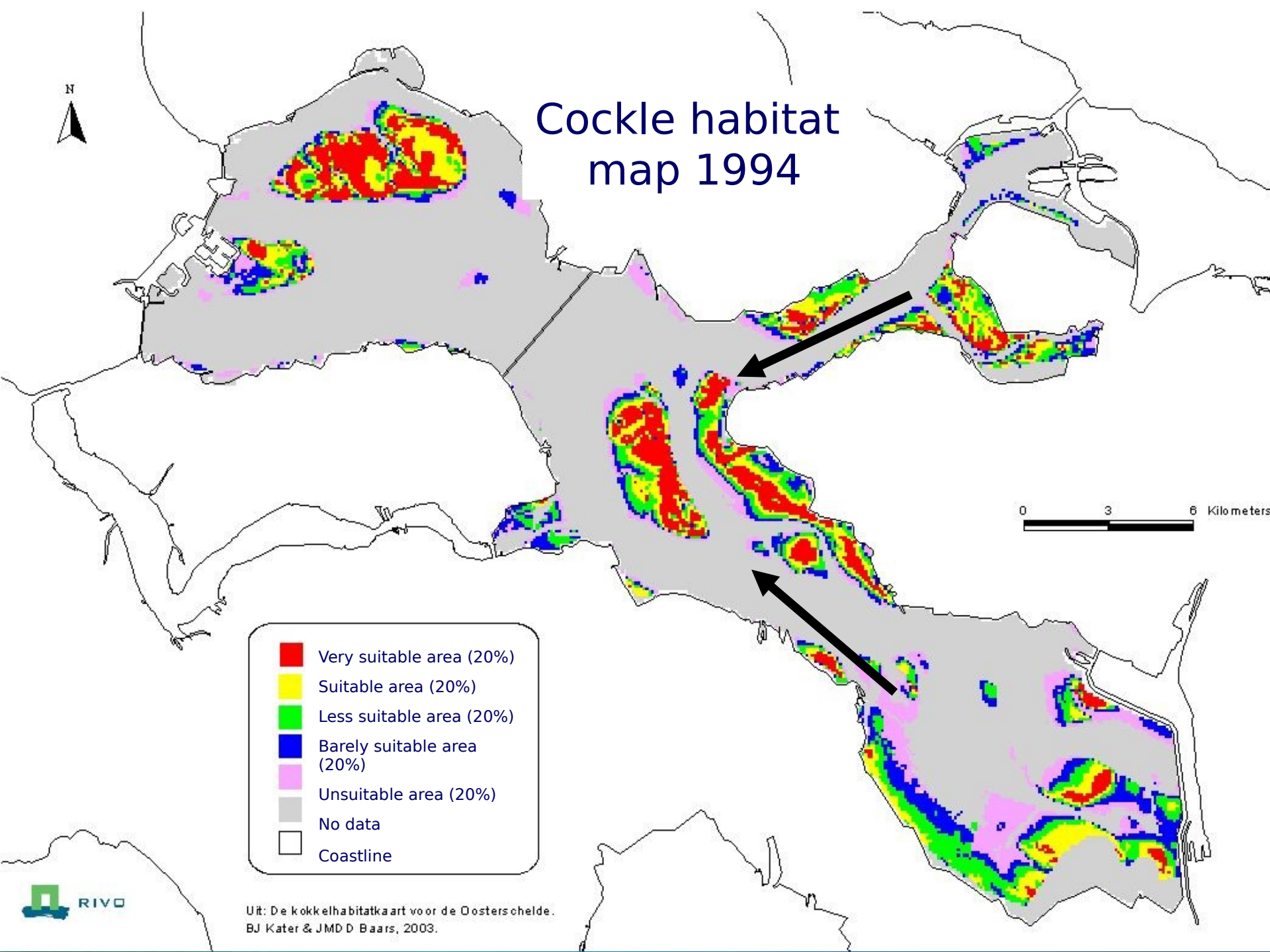


Mechanised cockle fisheries


Cockle habitat map 1983
N
0 3 6 Kilometers
Very suitable area (20%)
Suitable area (20%)
Less suitable area (20%)
Barely suitable area (20%)
Unsuitable area (20%)
No data
Coastline
RIVO
Uit: De kokkelhabitatkaart voor de Oosterschelde.
BJ Kater & JMD D Baars, 2003.


Cockle habitat map 1994
N
0
3
6 Kilometers
Very suitable area (20%)
Suitable area (20%)
Less suitable area (20%)
Barely suitable area (20%)
Unsuitable area (20%)
No data
Coastline
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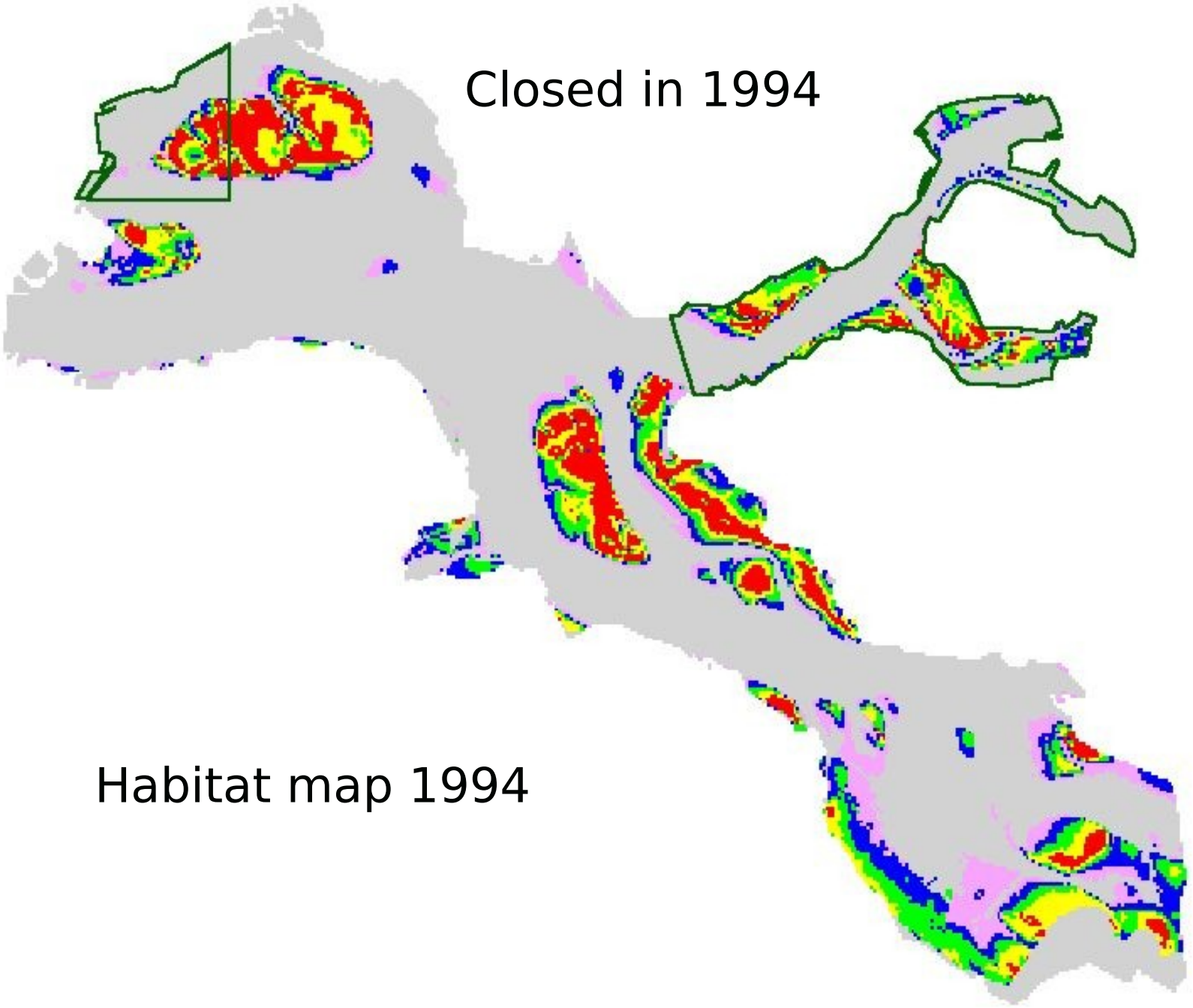
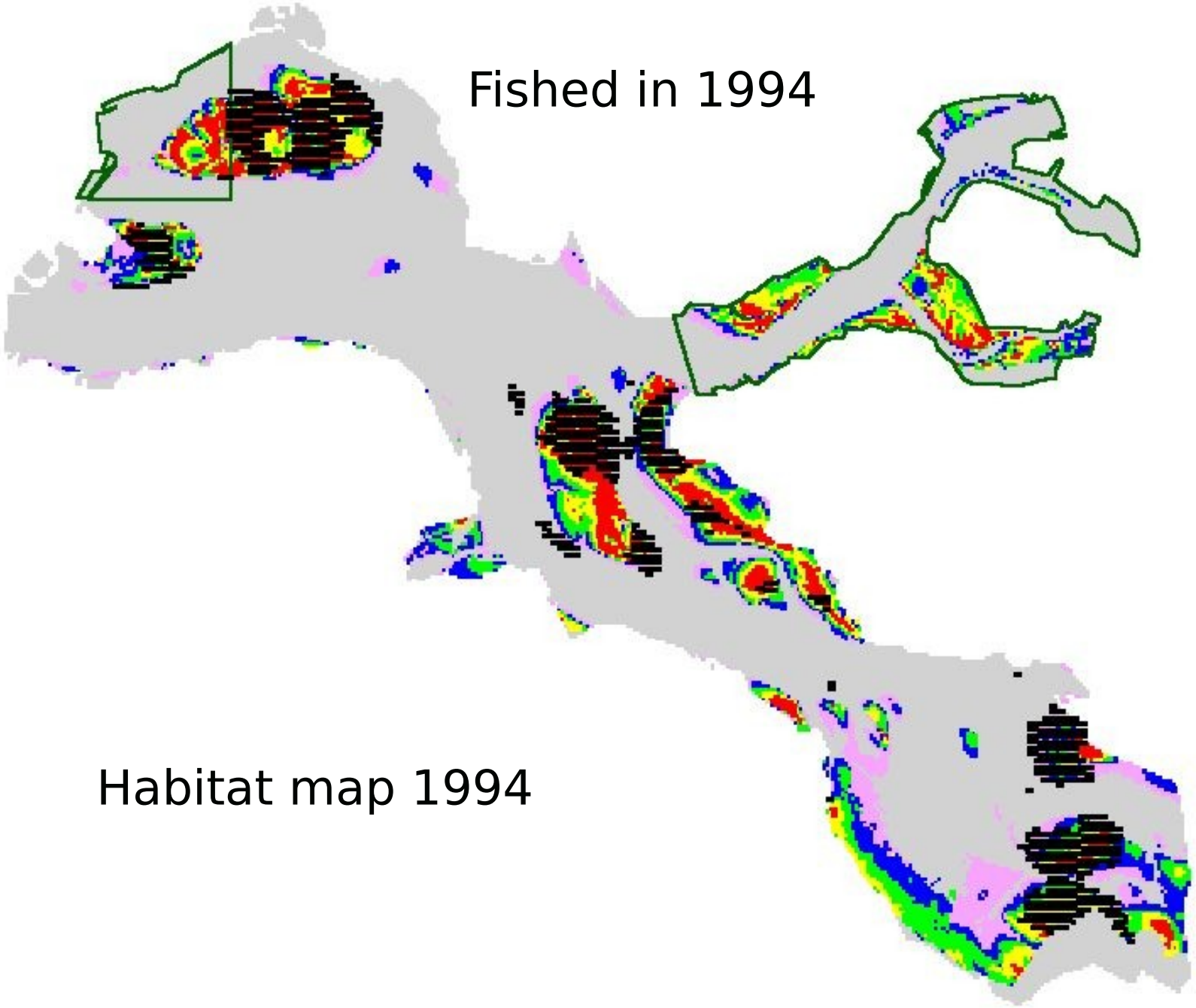
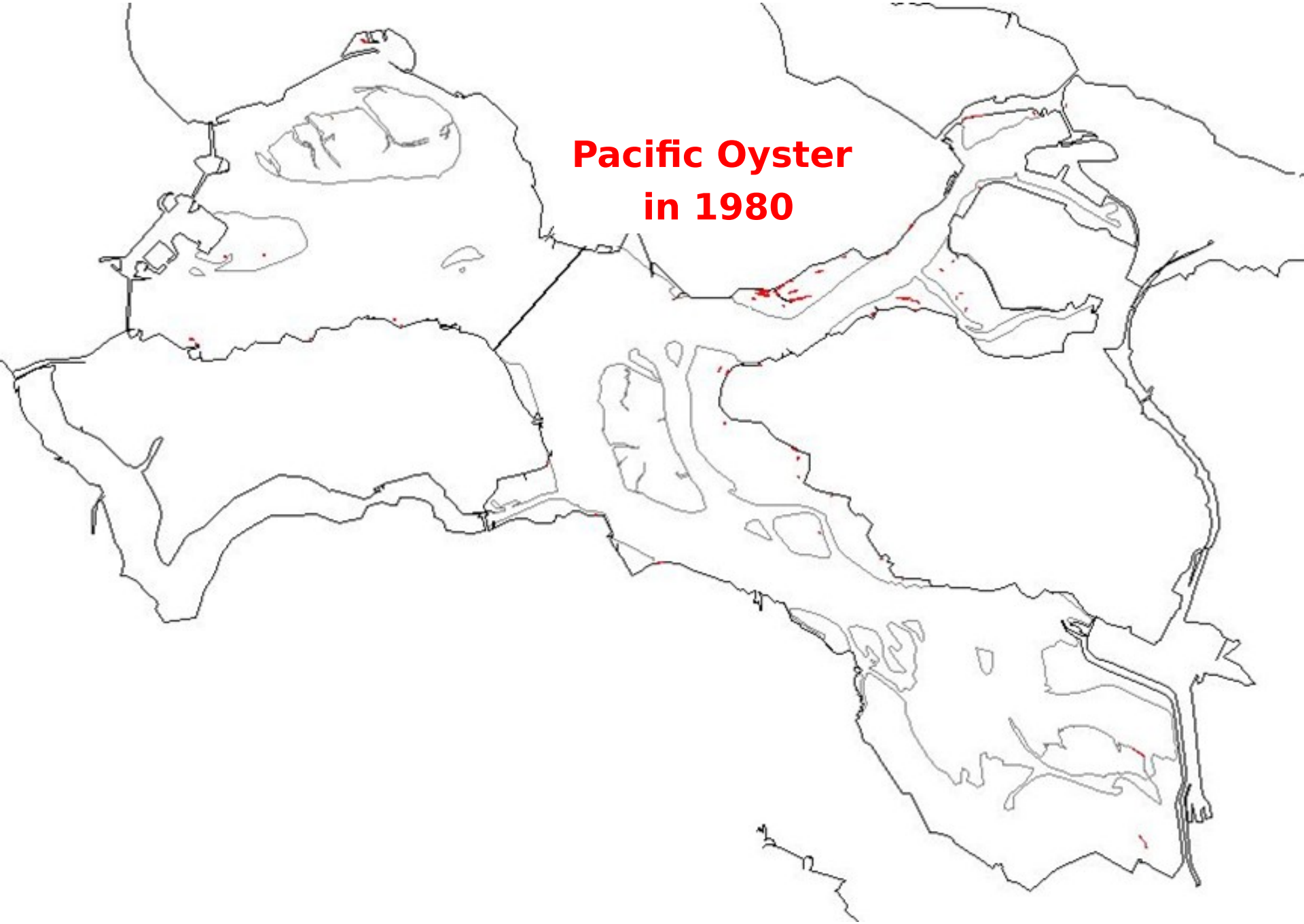
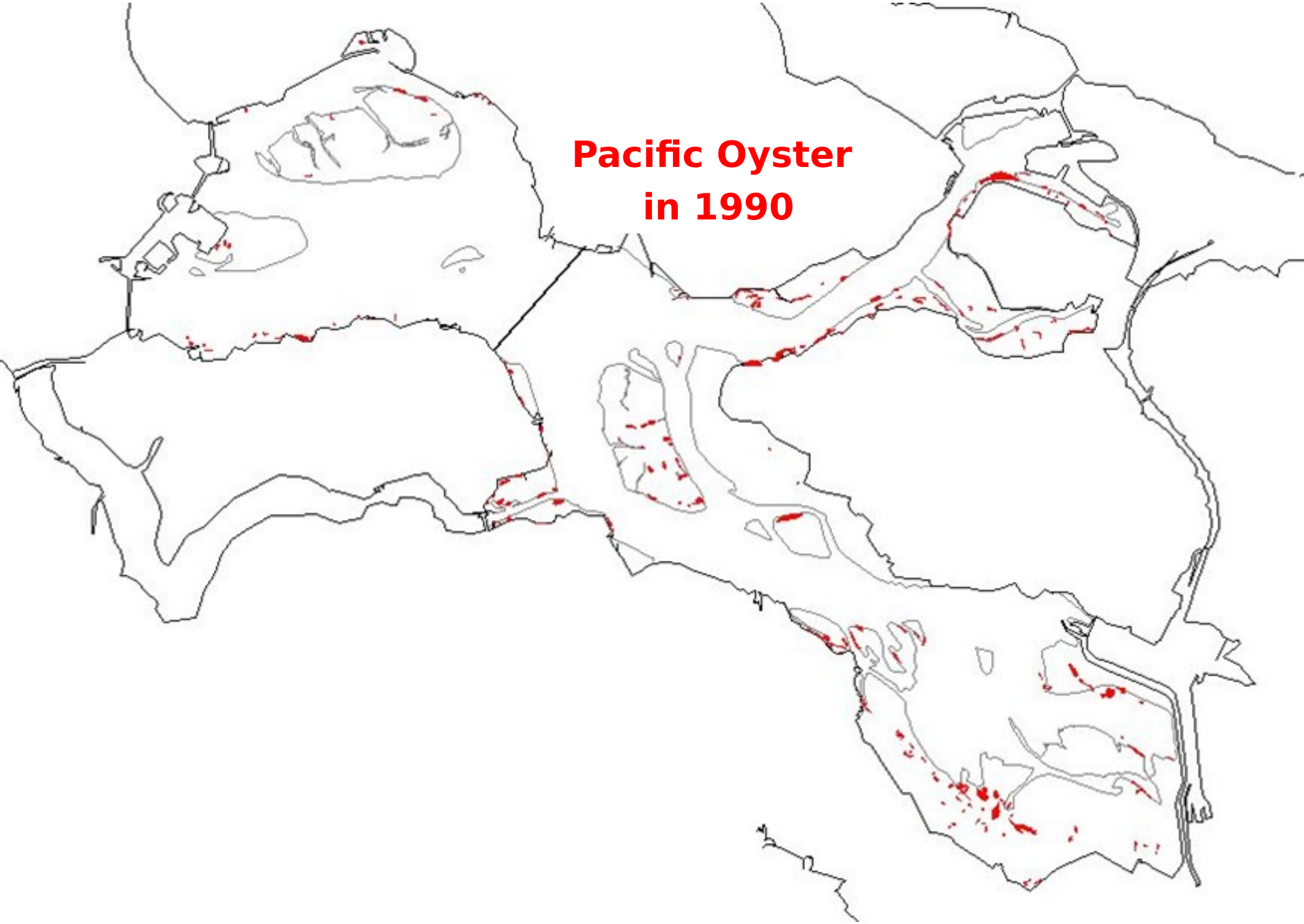
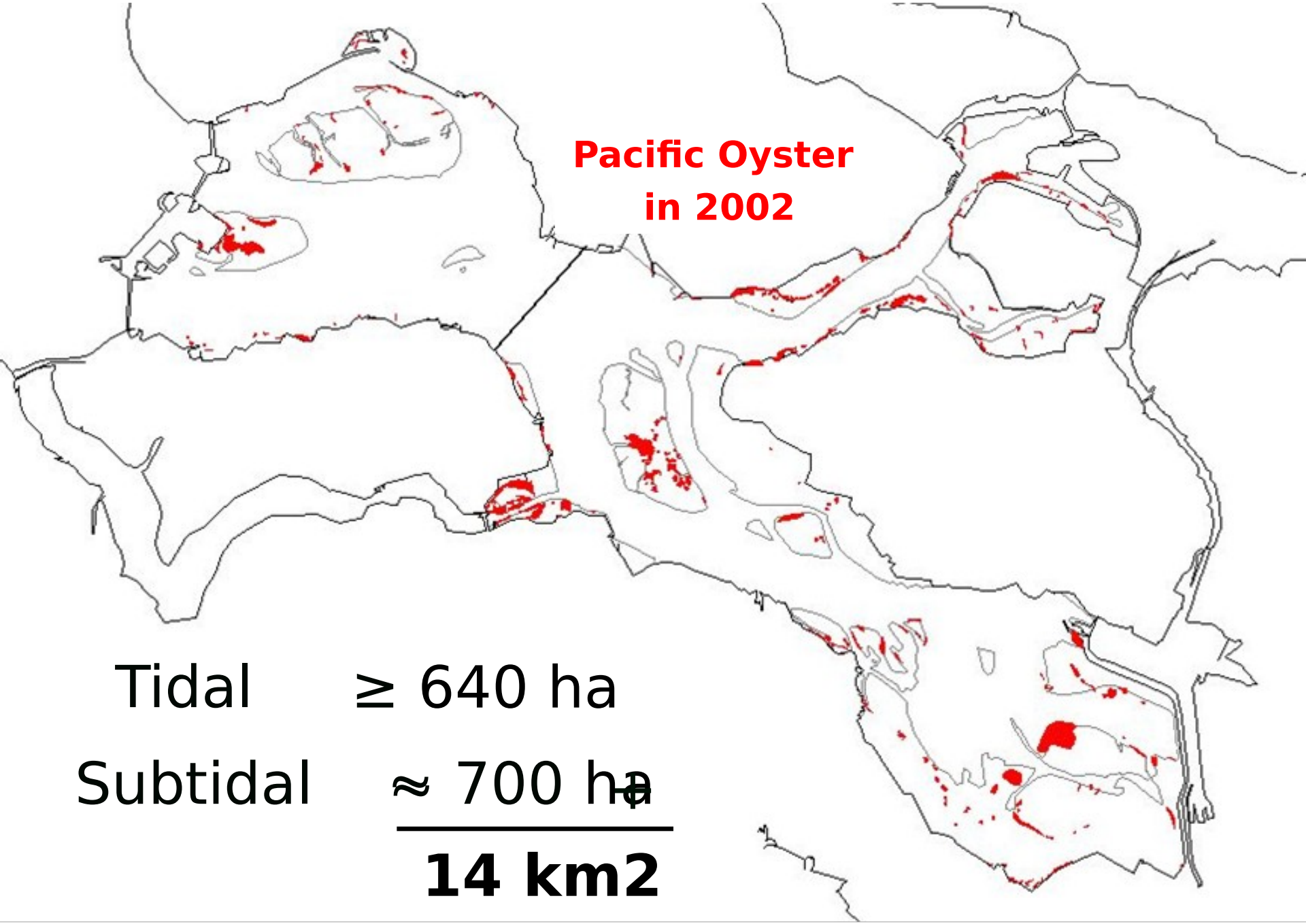

Closed in 1994
Habitat map 1994


Fished in 1994
Habitat map 1994

Unlimited spreading of the introduced Pacific oy


Pacific Oyster
in 1980

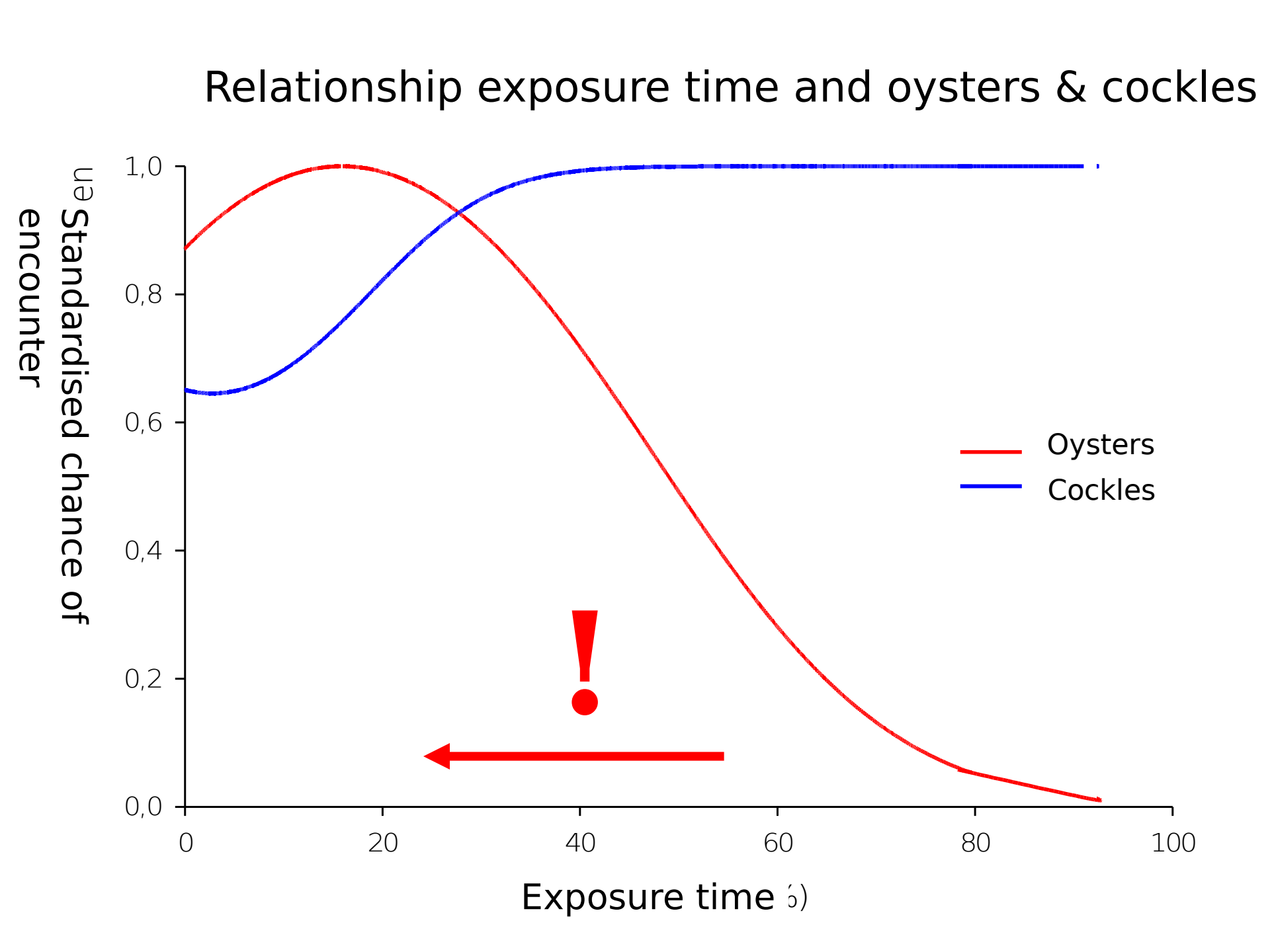

Pacific Oyster
in 1990



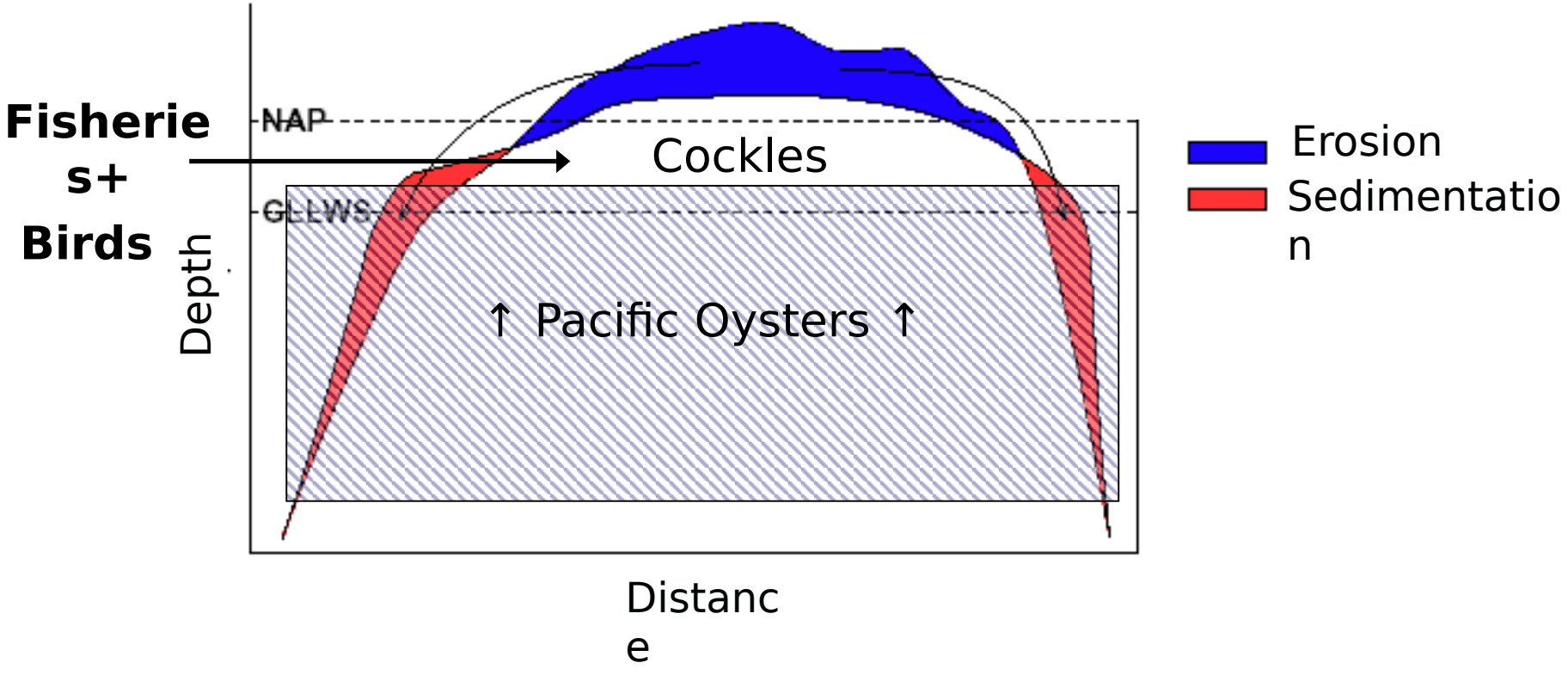
Tidal ≥ 640 ha

Subtidal ≈ 700 ha

14 km2


Relationship exposure time and oysters & cockles
Standardised chance of encounter
1,0
0,8
0,6
0,4
0,2
0,0
0
20
40
60
80
100
Exposure time
Oysters
Cockles
!

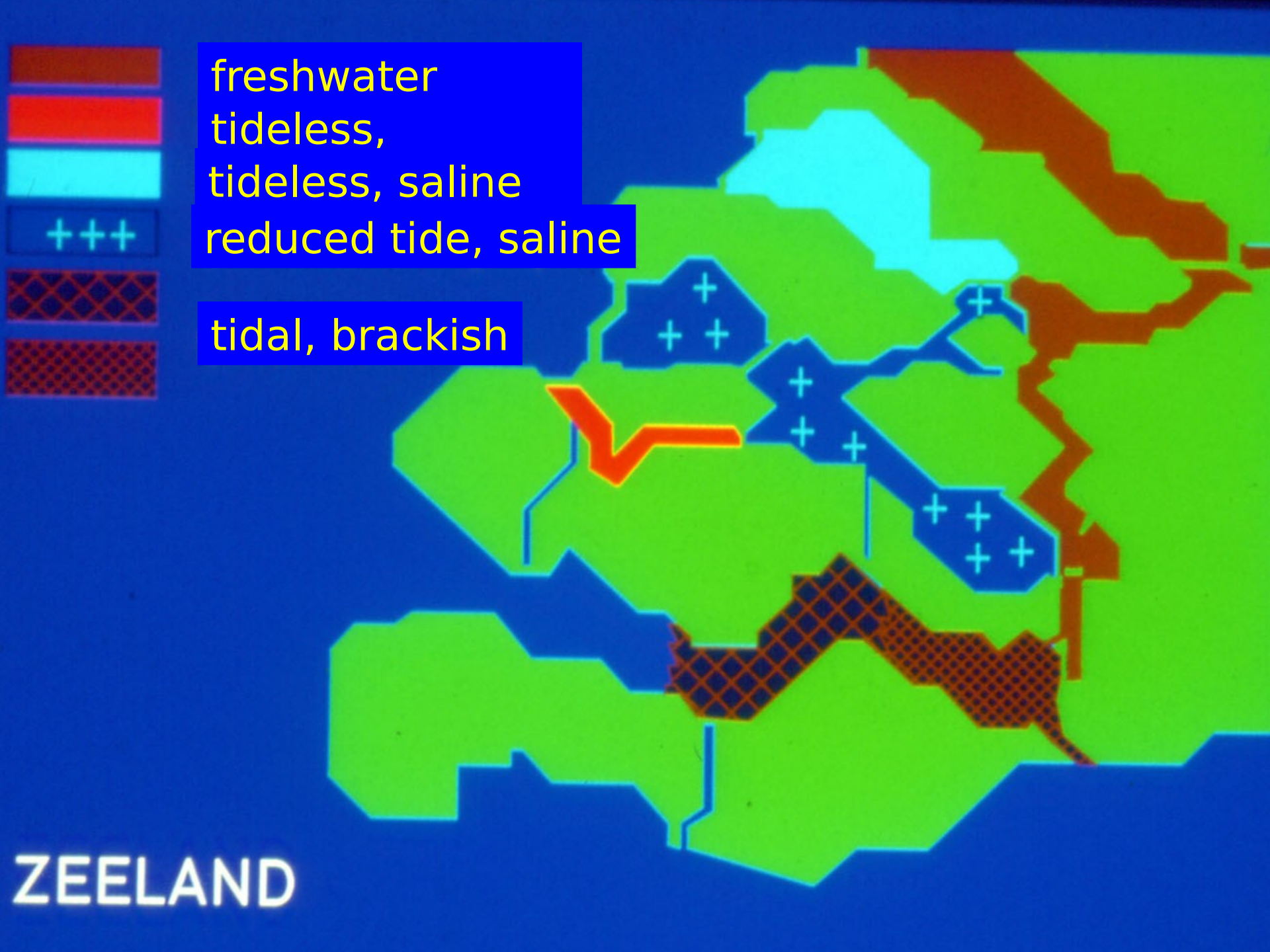
Growing conflict fisheries & birds



NAP: Dutch Ordinance Level

GLLW: Mean Low Waterlevel at Springtide

Aftercare is an inevitable
part of the project


freshwater
tideless,
tideless, saline
reduced tide, saline
tidal, brackish
ZEELAND

Satellietbeeld AGI, Rijkswaterstaat, ESA

Conclusion restoration:

- All Dutch Delta waters have been heavily modified by alteration of driving processes like tidal influence, salinity regime, river- and morphodynamics
- Restoration of estuarine dynamics is partly possible
- But: even with great efforts the restoration of morphodynamical processes (sedimentation, erosion, sand and silt transport) needed to preserve intertidal areas, stays behind in the case of the Oosterschelde...

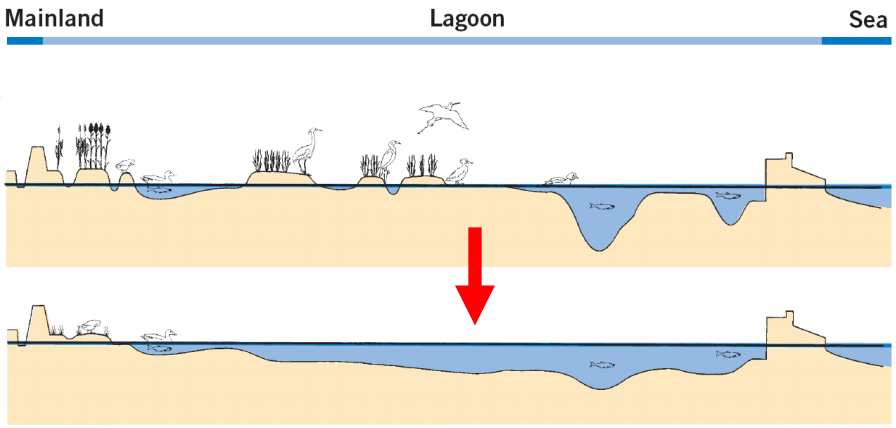
Lagoon of Venice

THE PROBLEMS OF THE VENICE LAGOON

The well known problem: floods with increasing frequency and intensity

The less known problems: loss of sediments,
flattening of shallow waters
loss of marshlands and habitats
increasing water depth
inadequacy of the coastal protection
pollution from the drainage basin
pollution in the sediments
increase of human pressure
- port activities
- navigation
- urbanization of the mainland
- agriculture
- intensive fishing
- tourism

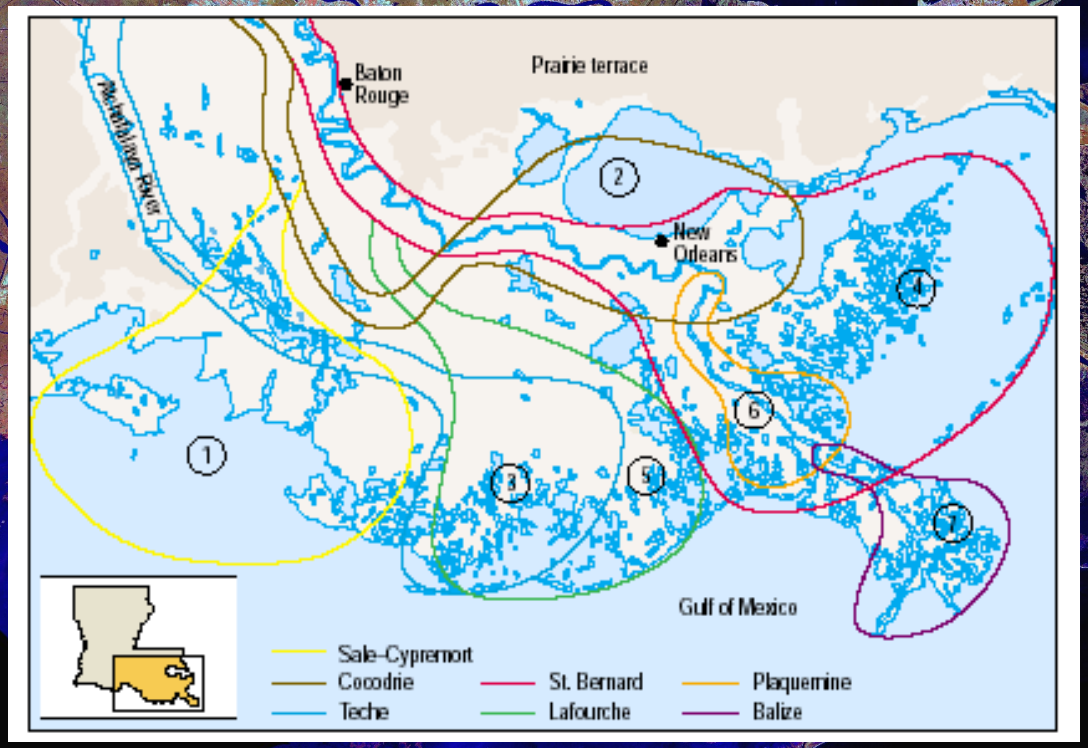
Alteration of the morphological structures



Mississippi Delta Plain

7000 years of sediment depos

Land loss balanced by land ga



3000-4000 yrs old

Thickest and youngest

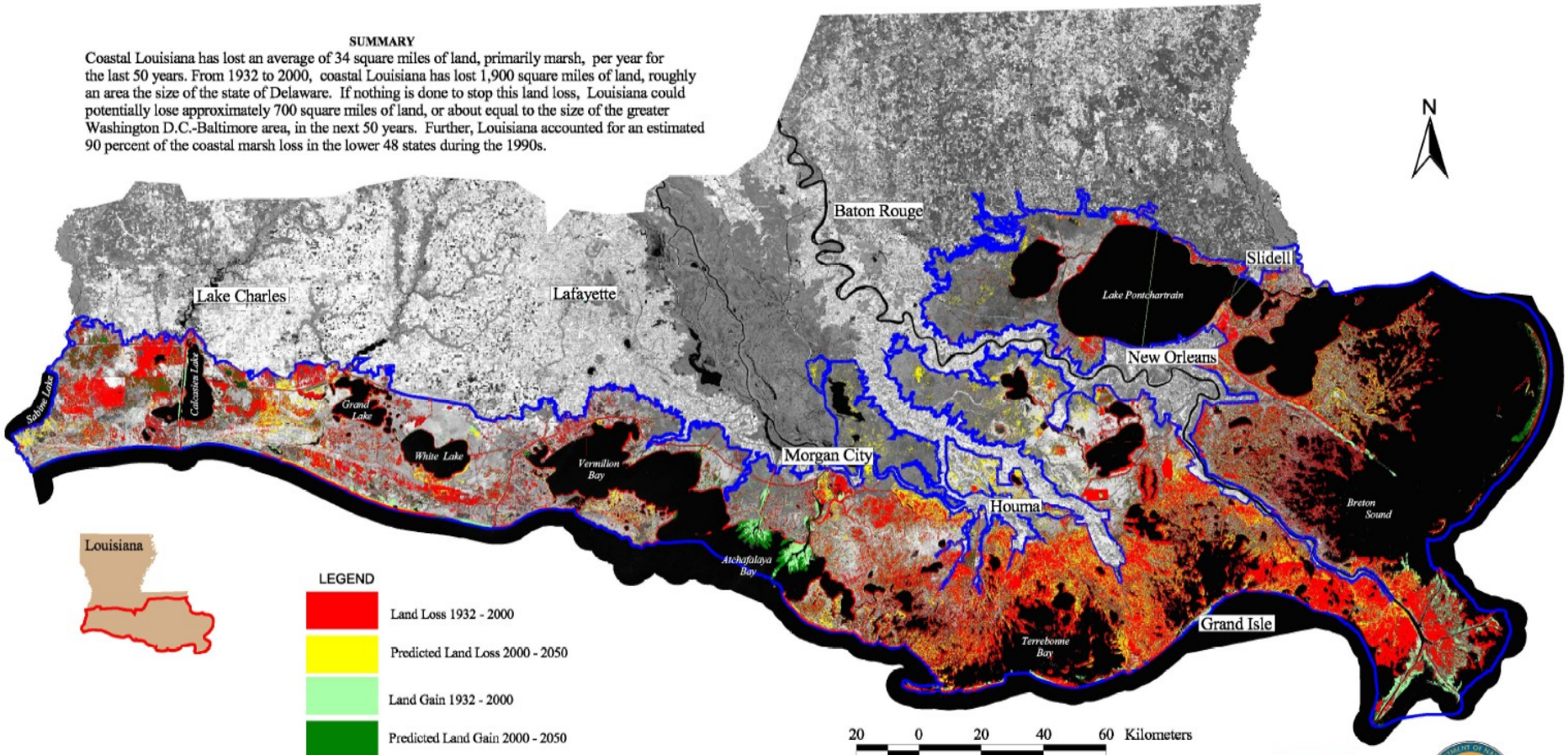
Varying sediment thickness

100+ Years of Land Change for Coastal Louisiana

USGS
science for a changing world

SUMMARY

Coastal Louisiana has lost an average of 34 square miles of land, primarily marsh, per year for the last 50 years. From 1932 to 2000, coastal Louisiana has lost 1,900 square miles of land, roughly an area the size of the state of Delaware. If nothing is done to stop this land loss, Louisiana could potentially lose approximately 700 square miles of land, or about equal to the size of the greater Washington D.C.-Baltimore area, in the next 50 years. Further, Louisiana accounted for an estimated 90 percent of the coastal marsh loss in the lower 48 states during the 1990s.



Background is 2000 Thematic Mapper panchromatic band.

Prepared by:
U.S. Geological Survey
National Wetlands Research Center
Lafayette, LA

Map ID: USGS-NWRC 2003-03-085

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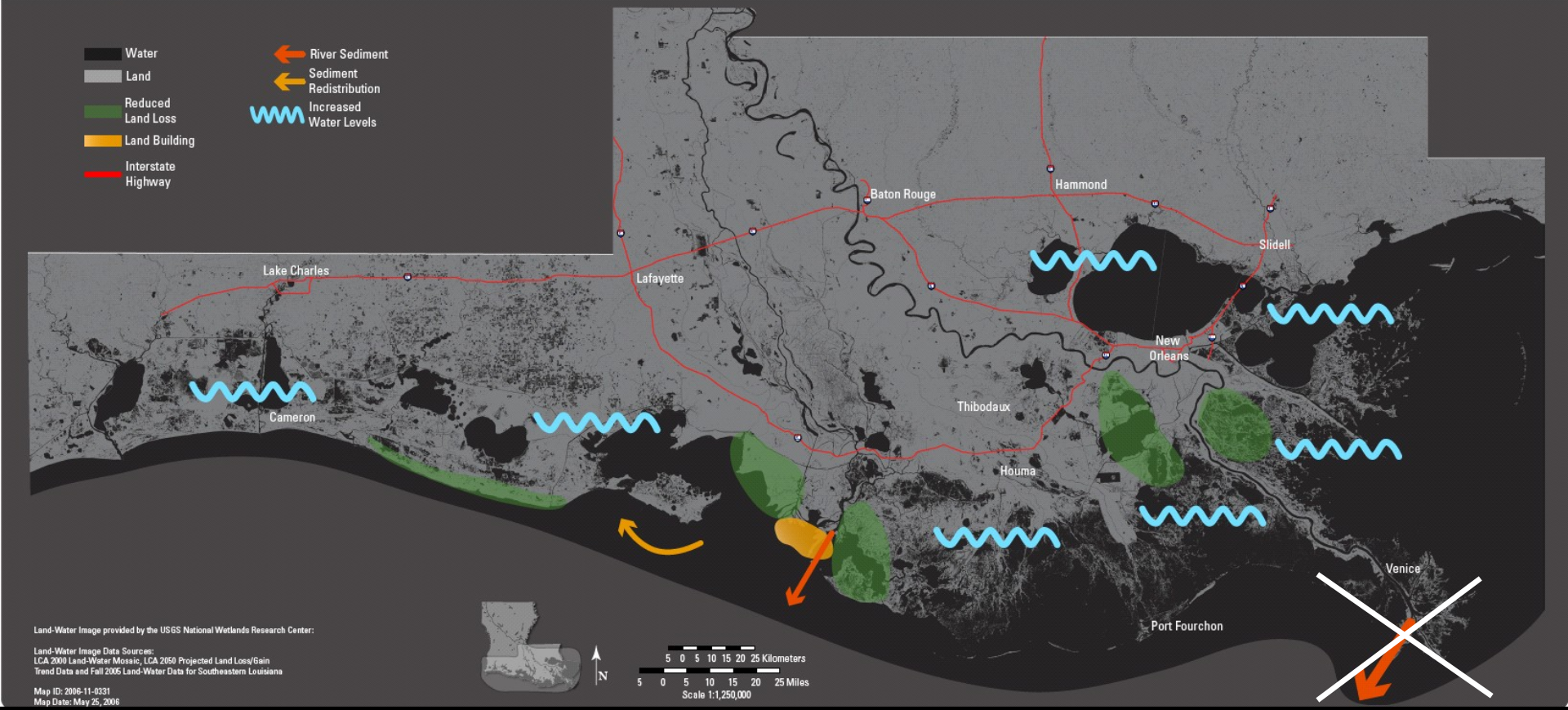
Continuing Current Management



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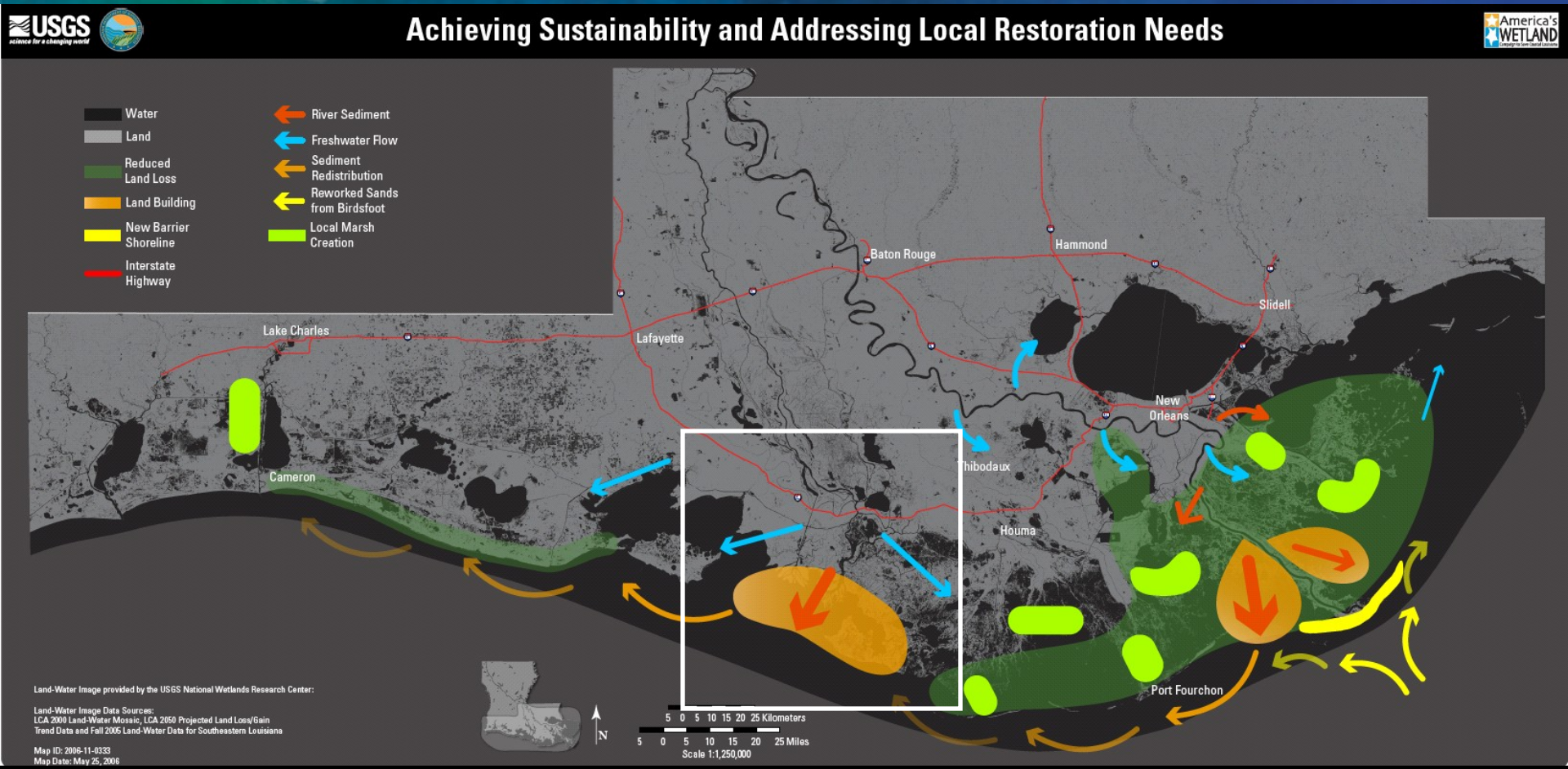

With: 60 cm/100yrs sea level rise & 40 cm/100yrs subsidence

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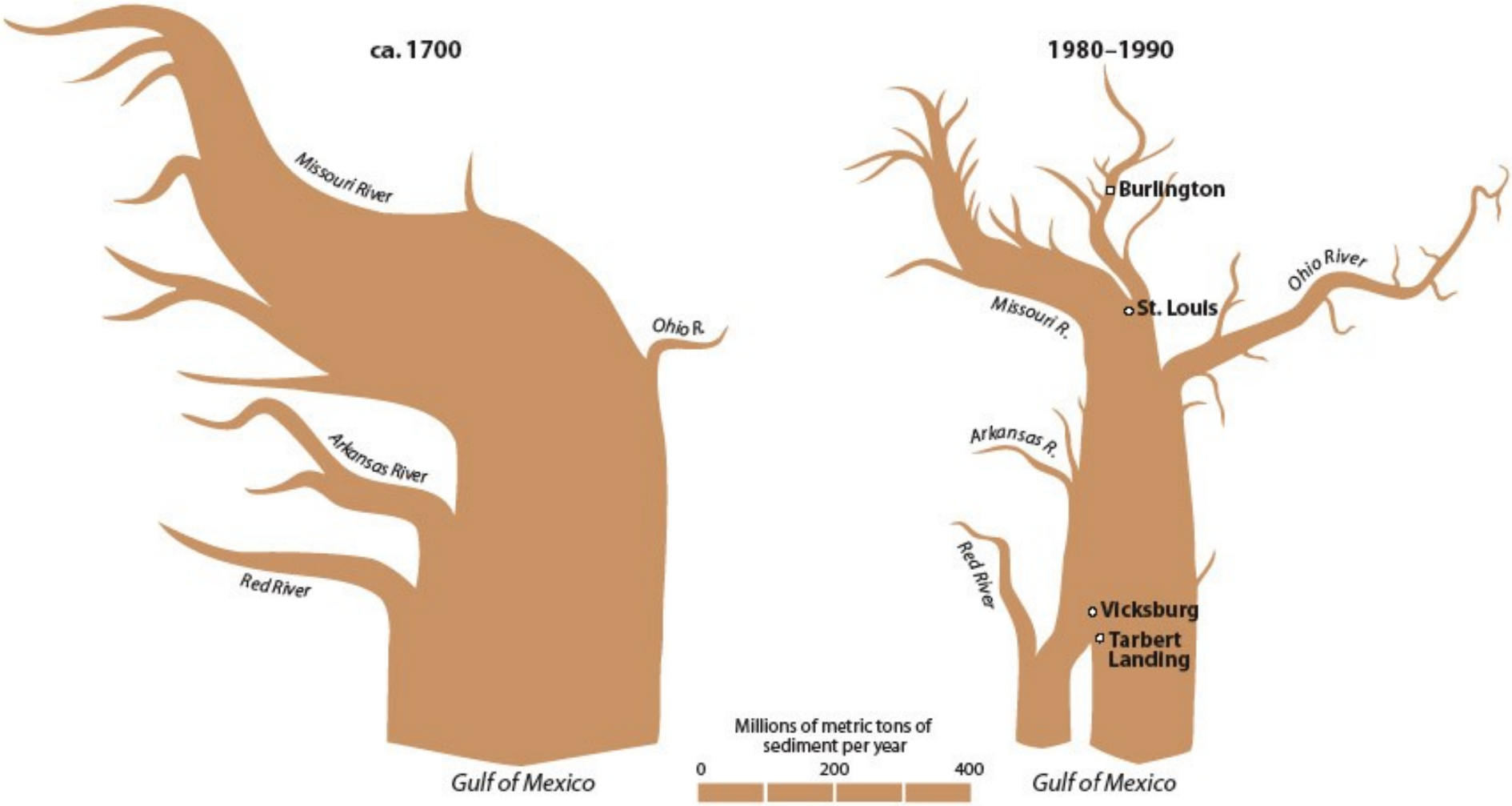
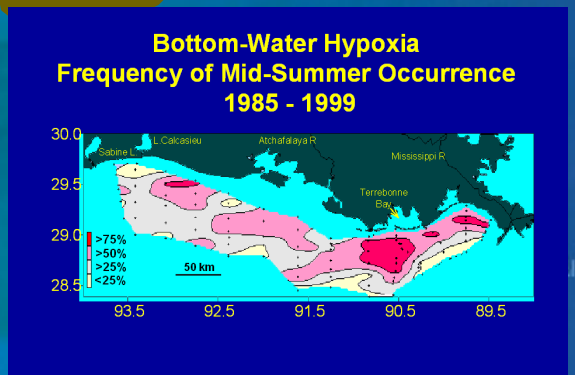
Sediment load decreased by 50%



Mississippi River Drainage Basin

Basin Facts

- Drains 41% of continental U.S.
- Includes 31 states & 2 Canadian provinces
- Total area drained 1.2 million square miles



ut voor Kust en Zee/RIKZ

Lessons learned:

- An integrated water system approach is a must!
- There are many ways to reach safety, but who makes the choice?
- Some effects are predictable, others are not
- Aftercare is an inevitable part of the project
- Estuaries are irreplacable
- Preserve/restore natural processes! These are essential for a sustainable delta landscape and the